popliteal artery. Fourteen days later the leg was amputated. A severe hemorrhage followed the operation, so that the man was again transfused. On the third day, a slight rash, not unlike serum rash, had developed, accompanied by a temperature of 101 F. The following day the temperature was down to normal, and the rash cleared up without further disturbance.

CONCLUSIONS

1. Timely blood transfusion for hemorrhage is a specific cure.

2. For hemorrhage and shock, results are good, but not specific.

3. For pure shock early transfusion, that is, transfusion before the "gray-blue" stage is reached, is useful, and is the most efficient treatment. Transfusion in the gray-blue stage is of little use. In this class, no other treatment has been useful.

FURTHER EXPERIENCE WITH FACE MASKS *

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When the Durand Hospital of the John McCormick Institute for Infectious Diseases was opened, rigid aseptic technic was adopted and the nurses were specially instructed in measures calculated to protect them from infections. From March 12, 1913, to Nov. 1, 1914, nine out of sixty-nine nurses, or 13 per cent., acquired clinical diphtheria. From this time on, all nurses giving a positive Schick test were immunized with diphtheria antitoxin. This practically eliminated active diphtheria; but from Nov. 1, 1914, to June 1, 1916, weekly throat cultures disclosed ten diphtheria bacillus carriers among forty-three nurses, or 23.25 per cent.

Up to June 1, 1916, nine cases of scarlet fever occurred among 112 nurses who were on duty, or in 8 per cent.

As we were unable to explain so many instances of infection through faulty technic, an effort was made to eliminate a possible factor of danger that had previously been largely ignored, namely, infection through mouth spray. Since June 1, 1916, gauze masks have been used by the nurses, and up to Oct. 1, 1918, six diphtheria bacillus carriers have been detected among seventy-three nurses, or 5.2 per cent.[1] No case of scarlet fever has occurred since masks were worn. The nurses are instructed to change the mask as soon as it has been known to be grossly contaminated, and never to put the hands to the mask to adjust it, etc., until the hands have been thoroughly washed.

Early in 1918, bacteriologic tests showed that the masks we were using did not remove all the bacteria thrown out in mouth spray. The masks consisted of two layers of gauze, 28 by 24 mesh; but as they were worn only once before washing and resterilizing, shrinkage soon made the openings in the gauze much closer than they were in the new masks.

Studies were instituted to learn how the masks could be made most efficient. The results that we have obtained agree very well with those recently reported by Haller and Colwell[2] and Doust and Lyon.[3] They are here presented as serving further to emphasize the importance of gauze masks of proper composition. When the probable importance of droplet infection in the dissemination of human tuberculosis attracted attention, gauze masks to be worn by the patient were advocated. Hamilton, in 1905, advised the use of gauze masks to cover the mouth of patients with scarlet fever when there were severe streptococcal complications and when the individual could not be properly isolated. In 1916, Meltzer advocated the use of a fine mesh net over the faces of patients with infantile paralysis and also over the faces of attendants. Various mechanical protections of the face were formerly used by physicians when swabbing throats and doing tracheotomy in cases of diphtheria. Gauze masks have been long used by many surgeons and their assistants with the purpose of protecting wounds from infection by mouth droplets.

Durand hospital mask, devised by Miss Charlotte Johnson, superintendent: The gauze (44 by 40 mesh) is cut 8 inches wide and 23 inches long. The sides and one end are turned down one-quarter inch. It is folded twice, the unturned end first, making a 7½-inch square. The opposite diagonal corners are cut off 1 inch and the raw edge is turned in one-half inch. It is stitched firmly all around. A 1-inch dart 1½ inches long is taken up at the middle of each side of the mask. A 14-inch tape is sewed on the opposite uncut corners. This mask has the advantage of covering the nose and mouth and in making the traction on the chin and not drawing on the nose and lips.

Our experiments were performed in a quiet room with no currents of air. It was assumed that the power of various gauzes to filter moist spray from air would increase with closeness of mesh and with the number of layers employed. In the first tests a spray of carbolfuchsin was employed, the dye being susceptible of fairly accurate measurements. It was thrown as spray by a hand atomizer. Briefly, these tests showed that the percentage of fuchsin passing through the gauze becomes progressively less as the mesh of the gauze becomes closer and as the number of layers of gauze is multiplied.

* From the John McCormick Institute for Infectious Diseases.

1. Our experiences up to Dec. 1, 1917, were reported by Weaver, G. H.: The Value of the Face Mask and Other Measures in Prevention of Diphtheria, Meningitis, Pneumonia, etc., THE JOURNAL A. M. A., Jan. 12, 1918, p. 76.

2. Haller, D. A., and Colwell, R. C.: The Protective Qualities of the Gauze Face Mask, THE JOURNAL A. M. A., Oct. 12, 1918, p. 1213.

3. Doust, B. C., and Lyon, A. B.: Face Masks in Infections of the Respiratory Tract, THE JOURNAL A. M. A., Oct. 12, 1918, p. 1216.

Similar tests were made by throwing a spray of a suspension of *Bacillus prodigiosus* in salt solution against gauze and estimating the number of colonies developing on plates exposed on the opposite side. It was found that the number of colonies became progressively less as the mesh of the gauze became finer and as the number of layers of gauze increased. It was noted that at a distance of from 3 to 5 feet from the spray, the proportion of the bacteria reaching that point which passed through the gauze barriers was greater than at shorter or greater distances. This is probably to be explained by the more rapid precipitation of the larger particles as regards the nearer distances and by the failing force at greater distances. These results demonstrated that gauze will remove bacteria from air when carried in a moist spray. The efficiency of the gauze as a filter is in direct ratio to the fineness of mesh and the number of layers used.

Further tests were now made to determine the efficiency of gauzes of various meshes and in different numbers of layers as filters for mouth spray. A suitable subject for these tests was found in an adult who was affected by a chronic antrum and ethmoid suppuration with constant purulent discharge, in whose throat and mouth *Streptococcus viridans* in abundance was constantly present. It was found that a mouth spray very rich in bacteria was discharged by this patient when the cheeks were distended with air and then, the lips being suddenly opened a little, the air was forced out with an explosive puff. The spray produced in this way was more abundant than that following coughing, and the driving force was greater, thus furnishing a very severe test as to the filtering power of obstructing gauze. Tests were made by having the patient direct such forcible expiratory efforts toward vertically placed Petri dishes containing blood agar at a distance of 6 inches, the face being uncovered and covered by various gauzes in different multiples. The results shown in Table 1 were obtained on a day when the streptococci were especially abundant. The colonies developing on the plates after twenty-four hours in the incubator were practically all of *Streptococcus viridans*. It will be noted that the coarser gauze allowed a large proportion of the bacteria to pass through, even when six layers were interposed. On the contrary, the finer gauzes removed many more of the bacteria, and when six and eight layers were used, almost all the bacteria were held back.

TABLE 1.—NUMBER OF COLONIES OF STREPTOCOCCUS VIRIDANS DEVELOPING ON BLOOD-AGAR PLATES EXPOSED AT 6 INCHES TO TWO EXPLOSIVE EXPIRATORY EFFORTS IN WHICH THE CHEEKS WERE FIRST DISTENDED WITH AIR AND THEN THE LIPS FORCED SLIGHTLY APART WITH A PUFF

Number of Layers of Gauze	Mesh of Gauze: 20 by 14		24 by 20		28 by 24		32 by 28		44 by 40	
	No.	%	No.	%	No.	%	No.	%	No.	%
0	2,000	...	2,000	...	2,000	..	2,000	..	2,000	..
1	2,000	100	2,000	100	1,500	75	1,500	75	1,500	75
2	1,500	75	1,500	75	1,500	75	800	40	800	40
4	800	40	800	40	1,000	50	500	25	80	4
6	500	25	200	10	50	2.5	5	0.25	0	0.0
8	100	5	15	0.75	0	0.0	1	0.05	0	0.0

Similar results were secured when a culture of *B. prodigiosus* had been smeared on the pharynx and tongue shortly before the test; in this case only the colonies of *B. prodigiosus* were counted.

TABLE 2.—NUMBER OF COLONIES OF STREPTOCOCCUS VIRIDANS DEVELOPING ON BLOOD-AGAR PLATES WHEN EXPOSED TO TWO EXPLOSIVE COUGHS WITH LIPS SLIGHTLY PARTED

Distance from Mouth to Plate	No. Gauze	Three Layers of Gauze (44 by 40): Over Face	Three Layers of Gauze (44 by 40): Over Plate	Colonies	Per Cent. Passing Through	Per Cent. Excluded
6 inches.....	+	....	....	150	....	....
6 inches.....	....	+	....	20	13.3	86.7
6 inches.....	....	....	+	16	10.6	89.4
1 foot.....	+	....	....	150	....	....
1 foot.....	....	+	....	8	5.3	94.7
1 foot.....	....	....	+	12	8.0	92.0
2 feet.....	+	....	....	2	....	....
2 feet.....	....	+	....	1	50.0	50.0
2 feet.....	....	....	+	1	50.0	50.0
3 feet.....	+	....	....	1	....	....
3 feet.....	....	+	....	0	0.0	100.0
3 feet.....	....	....	+	0	0.0	100.0

There appeared to be no appreciable difference between dry and moist gauze in filtering properties. Since three or four layers of gauze with a mesh of 44 by 40 removed most of the bacterial spray thrown with unusual force at a short distance, further tests were carried out to learn how efficient as filters of mouth spray three layers of this gauze would be when placed over the mouth of the person discharging the spray and over the exposed plate at varying distances, corresponding to the face of the person in the neighborhood. The plates were placed vertically as in the preceding experiment. The expiratory effort consisted of two strong coughs with the lips slightly parted.

Tables 2 and 3 show the results of two such experiments, similar ones with slight variation being secured many times. The same person served in these tests as those reported above. When the gauze mask was over the face, very few colonies developed in the plates. When the gauze was over the plates, the proportion of colonies as compared to unobstructed plates was also small, but slightly larger because here the

TABLE 3.—NUMBER OF COLONIES OF BACILLUS PRODIGIOSUS DEVELOPING ON AGAR PLATES WHEN EXPOSED TO TWO EXPLOSIVE COUGHS WITH LIPS SLIGHTLY PARTED, THE PHARYNX AND TONGUE BEING PREVIOUSLY SMEARED WITH A CULTURE OF BACILLUS PRODIGIOSUS

Distance from Mouth to Plate	No. Gauze	Three Layers of Gauze (44 by 40): Over Face	Three Layers of Gauze (44 by 40): Over Plate	Colonies	Per Cent. Passing Through	Per Cent. Excluded
6 inches.....	+	....	....	35	....	....
6 inches.....	....	+	....	0	0.0	100.0
6 inches.....	....	....	+	1	2.9	97.1
1 foot.....	+	....	....	32	....	....
1 foot.....	....	+	....	1	3.1	96.9
1 foot.....	....	....	+	1	3.1	96.9
2 feet.....	+	....	....	9	....	....
2 feet.....	....	+	....	2	22.2	77.8
2 feet.....	....	....	+	1	11.1	88.9
3 feet.....	+	....	....	2	....	....
3 feet.....	....	+	....	1	50.0	50.0
3 feet.....	....	....	+	1	50.0	50.0

finer particles are dealt with. At a distance of 2 or 3 feet, relatively more of the particles reaching that distance pass through because here only very fine particles are projected. In the cases in which *B. prodigiosus* was smeared over the pharynx and tongue, fewer colonies developed in plates placed behind gauze obstruction. This is probably because the bacteria were less thoroughly distributed in the saliva. If the colonies that develop on unobstructed plates placed near the month are examined under magnification, it is noticed that many are compound colonies; and many of those that develop from the larger particles of saliva are the result of the growth of clumps of bacteria. Thus the number of bacteria removed is greater than the number of colonies would indicate. These larger particles of saliva are probably more dangerous, not only because they contain more bacteria but also because the toxic substances contained in the projected mucus may act on the mucous membrane where they lodge so as to favor the growth and penetration of the associated bacteria. Since the completion of these studies, the masks used in Durand Hospital have been made of three layers of gauze with a mesh of 44 by 40. The nurses are instructed to wear two superimposed masks, making six layers of gauze, when caring for cases of virulent infections in which secretions are abundant. The gauze that we have used is absorbent. It is probably preferable to buttercloth, which is treated to make the material nonabsorbent. Particles of mucus will adhere more quickly and firmly to the absorbent material, as the rapid removal of the water leaves a thicker and more sticky residue. So far we have been able to secure but one weave of buttercloth, about 28 by 30, and this is not as fine a mesh as is desirable. Even this is very difficult to find, most large dealers having none in stock and usually not knowing where it can be secured. In any case the dressing is removed in washing. Our experience with masks has been principally confined to their use to protect attendants on the sick from infection. They have been used not only by nurses, but also by physicians in their work while taking cultures from throats, doing intubations and examining chests. The mask on the face interferes with putting the hands to the mouth and nose, and so indirectly becomes a source of safety to the individual, whose hands are apt to be contaminated in her work and who thoughtlessly may put them to the face. We have also used masks over the faces of mothers while nursing their babies, when either one has been infected by diphtheria or has been a diphtheria carrier.

The employment of gauze masks over the face to prevent the transfer of infections to others was thoroughly worked out and practically applied by Capps[4] at Camp Grant. He used masks to prevent cross-infections in ambulances and in the admission rooms and wards of the hospital. Similar use of masks has since been generally adopted in Army and Navy camps and in many civil hospitals. The intelligent use of gauze masks and other measures may be instituted equally well in private families. Many family epidemics might be limited by such means. In all instances in which infections locate in the respiratory tract and in which the infectious agent is discharged in mouth spray, it is reasonable to protect those about the patient by masks of gauze.

The present concentration of effort to limit droplet infection should not prevent an equally energetic effort to close other channels of spread of infectious materials. The use of face masks may serve to give an unwarranted feeling of security to those employing them if they neglect the measures that prevent carriage of infectious materials through other agents. Emphasis must still be placed on proper sterilization of eating utensils, destruction of all infectious discharges, avoiding all contamination of foods, and special care regarding the washing of the hands every time the sick are handled.

4. Capps, J. A.: Measures for the Prevention and Control of Respiratory Infections in Military Camps, THE JOURNAL A. M. A., Aug. 10, 1918, p. 448.

New and Nonofficial Remedies

THE FOLLOWING ADDITIONAL ARTICLES HAVE BEEN ACCEPTED AS CONFORMING TO THE RULES OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION FOR ADMISSION TO NEW AND NONOFFICIAL REMEDIES. A COPY OF THE RULES ON WHICH THE COUNCIL BASES ITS ACTION WILL BE SENT ON APPLICATION. W. A. PUCKNER, SECRETARY.

PNEUMOCOCCUS VACCINE (See N. N. R., 1918, p. 337-8).

A vaccine or "antigen" is prepared by E. C. Rosenow (THE JOURNAL, March 16, 1918, p. 759) by digesting a suspension of pneumococci at 37 C. until about 95 per cent. of the organisms have become gram-negative and the mixture is relatively nontoxic to guinea-pigs.

Actions and Uses.—(See N. N. R., 1918, p. 337-8.)

E. C. Rosenow believes that the protective power against pneumococcus infection is greater with a vaccine prepared according to his method than that of a vaccine made according to the usual method.

Eli Lilly & Co., Indianapolis.

Pneumococcus Antigen (Rosenow), Lilly.—Marketed in 5 Cc. vials, each Cc. containing 20 million partially autolyzed pneumococci.

Bacterial Examination of Green Vegetables.—Kurk (*Am. Jour. Pub. Health,* September, 1918) undertook an investigation to determine the presence of the coli-typhoid group of organisms, streptococci and anaerobic organisms on green vegetables. Samples were purchased at various stores about Chicago, one sample of watercress being obtained from a glass bowl containing water from a free lunch counter in a saloon. The culture mediums were made according to the standard methods of water examination of the American Public Health Association. Five organisms superficially resembling paratyphoid bacilli were isolated, but in no case did complete cultural and agglutination reactions determine that they belonged to this group. *B. coli* were found in twenty-two out of twenty-nine samples. Of samples from twelve stores classed as clean, eleven showed *B. coli;* of ten samples from stores classed as fair, six showed *B. coli,* and of six from dirty stores five contained *B. coli.* Streptococci were found on three samples—two from clean stores and one from a store classed as fair. *B. cloacae* were found on five samples, three from dirty stores and two from fair stores. A sample of green onions contained a great number of *B. cloacae,* as did a later sample of onions obtained from the same store. Mold spores were found on thirteen of twenty-nine samples; twenty-eight out of twenty-nine samples contained gas formers on lactose broth. The total bacterial count at 37 C. and 20 C. varied widely, the former from 6,000 to 4,300,000, and at the latter temperature from 18,000 to 25,800,000, the latter count being obtained from the sample of watercress from the saloon free lunch. Other than this the sanitary condition of the store did not seem materially to influence the bacterial count.